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When regional growth does not benefit from high-tech specialization? Explaining the experience of Latvian regions

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Abstract

Changes in technological structure of manufacturing towards high-tech sectors do not automatically lead to improvements in labour productivity. This can be as a trap for economically less developed regions, which tend to increase a presence of high-tech sectors in manufacturing structure, but as a result are not able to reach desirable improvements in economic growth. Using structural change and specialization indices and shift-share analysis technique, this paper analyses effect of structural changes in manufacturing sector on economic growth in Latvian regions. Empirical research findings highlight that those Latvian regions, which make a choice to have a technologically more developed manufacturing structure and pay less attention to the improvements of labour productivity turn out to be in the situation, when strengthening of specialization in high-tech sectors does not reflect in regional economic growth performance improvements. This, for example, is the case of the Latvian region with the lowest GDP per capita. The author finds out that changes of technological structure of manufacturing in favour to high-tech sectors without accompany of labour productivity growth do not provide desirable contribution in the improvements of economic growth performance and technologically less intensive sectors with higher labour productivity can contribute to the economic growth in bigger extent at this stage.

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Keywords: technological structure of manufacturing; labour productivity; structural changes; specialization; regional economic growth; Latvia

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1. Introduction

The article focuses on searching the reason, which hinders ability of regions to improve growth performance after increasing of specialization in high-tech manufacturing, using the case study of Latvia and Latvian regions. Author organizes the research in context of scientific debates on previous finance-dependent and debt-intensive economic growth. Because of debates, scientists (Radosevic 2014) put an issue on economic structure and its changes in the centre of improvements in economic growth among other reasons. The experience of severe GDP decline and persistent structural differences between high- and low-income economies rejuvenated necessity to bring forward technology-intensive and highly productive manufacturing (European Commission 2010, 2015). This finds its roots both in historical and empirical findings on economic success of advanced economies (Szirmai 2012). However, one could find that high productivity not always accompany high technological intensity. When regional growth does not benefit from high-tech specialization? Could technologically less intensive sectors contribute to the growth in bigger extent in this case?

Author is testing this hypothesis by the example of Latvian regions. Research findings can be useful for economically less developed regions. The experience of Latvia and Latvian regions is good base for testing the issue under research, because Latvia belongs to a transition phase between developing and developed economies (Ekonomikas Ministrija 2013) and its experience can offer some new facts for usual literature on developing and developed economies in context of structural changes. Moreover, the experience of Latvian regions provides case study about increasing high-tech specialization without desirable effect on regional growth.

The most important finding indicates that not only direction of structural changes is important, but also the improvements in labour productivity are necessary for receiving desirable improvements in regional growth from increasing of specialization in high-tech sector. Author finds out that technologically less intensive, but high-productive sectors contributes to the improvements of regional growth in bigger extent at this stage in Latvia.

The article is organized as follows. The second section offers short overview of the recent scientific contributions to the area of relationship between structural change, economic growth and labour productivity. Author considers desirable directions of structural change and requirements for making this process effective. The third section provides explanation of data and method used for the purposes of research by making accent on detailed presentation of logic of the research. Then research results demonstrate author's findings and the section fifth concludes the article.

2. Why does growth benefit from high-tech specialization and when it takes a place? Literature background

Many scientific contributions related to the issue on economic growth and regional prosperity focused on processes of structural changes in economy (Baumol 1967; Echevarria 1997; Hartwig 2010). Despite the fact, that introduction of structural changes in formal growth theories is relatively new (Echevarria 1997); structural changes manifested itself in a framework of variety of Endogenous growth theories (e.g. Roberts, Settefield 2007). This theoretical approach postulates necessity to work towards increase of high-productive sectors (Baumol 1967, Hartwig 2010) and finds evidence in empirical research results, which highlight that certain sectors are able to reach systematically higher labour productivity growth than others and those are desirable for resource reallocation (Peneder 2003, Janger et al. 2011). However, labour productivity level closely related to the technological intensity and it is easy to find out that higher output and higher value added per unit produced usually made within high-tech sector nor within low-tech sector, it is important to take into account that sectors differ by its potential to raise labour productivity across regions. Moreover, technological differences between high-income and low-income regions contribute to the lagging behind by labour productivity level within high-tech sectors also. The European experience demonstrates that economically less developed regions still are not able to close labour productivity gap at this moment, because of slow technological convergence (Filipetti, Peyrache 2015). Therefore, one could argue that high activity of regions towards diversification of their economic structures (Noseleit 2015) is closely related to the existing sectoral composition of economy (Boschma 2012; Urraca-Ruiz 2013) and its technological intensity (Neffke, Henning, Boschma 2011).

Thus, aim to be in a harmony with statements of the Endogenous growth theory and to adopt an experience of advanced economies can reinforce attempts of economically less developed regions to pursue mimicking of economically more developed regions under pressure of "league table ranking" effect (Šipilova 2013b). Partly peculiarities of convergence processes in Europe demonstrate this. For example, economically higher developed EU-

15 are experiencing convergence between internal regions, in contrast economically less developed Central and Eastern Europe is pursuing convergence between countries (Crespo Cuaresma, Doppelhofer, Feldkircher 2014). Palan and Schmiedeberg (2010) highlight that technological and economic progress without activities, which stimulate similar economic structure, is correct foundation for convergence. The process in this way is going on slow in Europe (Palan, Schmiedeberg 2010; Filipetti, Peyrache 2015). Moreover, Crowley and McCann (2015) using the case study of Irish firms proved that upgrades in productivity from innovation depends on innovation type and characteristics of economic agents, what one more time highlights that high-tech activities provide not only opportunities, but also requirements for regional economies. Such trends make difficult choice of direction of structural changes, especially for economies with limited technological capabilities. Additionally, scientists in discussions about new possibilities for collaboration in R&D area between industries and universities (Uitermark 2015) mention that efficiency of resource employment relates to understanding that extractive and resource sectors can find a place in the centre of the innovation policy, in case if these sectors characterise regional production structure (Addie, Keil, Olds 2015).

Structural changes differ for developed and developing economies. Technological innovation supports structural changes in developed economies whilst developing economies should change their production structure towards high-productive sectors due to their limited capacity to innovate and time needed for returns from investments in innovative activities and technologically intensive sectors. Particularly, economically less strong economies can upgrade from investments in technologically more intensive sectors only after reaching positive effect on growth performance from previous activities in technologically less intensive sectors (United Nations. Economic and Social Affairs 2006). This, in turn, highlights that structural changes towards increasing high-tech activities are gradual process and one know relatively few examples of fast catch-up. Improvements in quality of this process related to the option of focusing mostly on regional uniqueness and potential through the adoption of smart specialization strategy, constructing regional advantage or realizing connective regional policy. These approaches offer to introduce high technologies in traditional activities besides active reallocation of resources to the high-tech sectors (Hospers, Benneworth 2005; Midtkandal, Sörvik 2012; European Commission 2006, 2010, 2014; OECD 2014; Boschma 2012).

Usually scientific literature indicates that manufacturing is the most promising area for closing the gap between economically higher and lower developed economies (Maniyka et al. 2012). The ability of the sector to rise labour productivity, to provide externalities of technological development and to create new technologies holds this. Moreover, structural changes within manufacturing make growth faster (Ishikawa 1992).

The above mentioned allow author to conclude that structural changes towards high-tech sectors usually upgrade growth performance. Although, the absence of complete technological convergence between economically low and high developed regions hinders positive effects. This means that labour productivity and regional potential become important factors for realizing effective structural changes with positive effect on economic growth.

3. The methodology and data

This article analyses effect of structural changes in manufacturing on economic growth by testing structural changes in time (structural change indices) and in space (specialization) and labour productivity growth at sectoral level. Moreover, this article aims to find out reason, which hinders positive effect of increasing specialization in high-tech manufacturing sector on regional growth using the case study of Latvian regions. The research design has inspired by a sense of structural changes in context of Endogenous growth theory, which brings forward technological structure of economic activities and effectiveness of employment of resources (Baumol 1967, Hartwig 2010).

Scientific literature offers different understandings of labour productivity growth, taking into account technological evolution and reallocation of labour force between sectors of economic activity (McMillan, Rodrik 2010). Author bases empirical analysis on understanding, which assumes labour productivity growth because of labour force movement away from sectors with low labour productivity to sectors with high labour productivity. Regional and sectoral peculiarities affect labour productivity growth regardless of technological intensity also. Value added per person employed is numerical expression of labour productivity; in turn, shift-share analysis technique (Peneder 2002, Havlik 2005) is a tool for examining labour productivity growth due to labour force reallocation at sectoral level.

Author seeks to calculate data on labour productivity growth separately in manufacturing and in manufacturing in context of total economy. McMillan and Rodrik (2010) and Havlik (2005) highlighted the usefulness of this. Limitations of regional statistics for manufacturing sectors hinder possibility to examine labour productivity at the

regional level. That is why author offers to understand characteristics of labour productivity in manufacturing sectors at country's level. Then explanation of structural changes at regional level (five planning regions of Latvia) occurs.

First, author examines the nature, as well as speed and intensity of structural changes in manufacturing in Latvia. Author takes into consideration the nature of structural changes taking as a basis for calculations labour force reallocation "within" and "between" manufacturing sectors. This provides understanding whether preservation of the existing specialization is taking a place ("within" option) or technological structure of manufacturing is changing ("between" option) in accordance with the aim to increase significance of high-tech sector. Then correlation analysis discovers relationship between structural changes and GDP growth for detecting promising areas for further increasing of specialization. Second, author focuses attention on nature and direction of increasing of regional specialization and then relates it to the regional growth. Third, author employs a shift-share analysis technique for testing labour productivity growth in manufacturing at sectoral level and makes clear reasons for effect of increasing specialization in high-tech sector on regional growth. The regression analysis and particularly the technique of LOG-LOG model provides knowledge about effect of labour productivity growth on GDP per capita using the case studies.

Author provides numerical evaluation of structural changes taking as a basis calculation of two complementary indices, as Structural Change Index (SCI) and Modified Lilien Index (MLI) (Dietrich 2009). Author calculates regional specialization as commonly employed Localization Quotient (LQ) (Noseleit 2015) as offered in scientific literature (Gallego, Maroto 2015; Weterings, Marsili 2015). Data for calculations collected from European Commission's Eurostat database and Central Statistical Bureau of Latvia. Manufacturing technological structure consists from four sectors – high-, me-high-, me-low-, low-tech – in accordance with Eurostat high-tech aggregation. Author combines them as "High-, me-high-tech" and "Low-, me-low-tech" for research purposes also.

4. Research results

As far as structural changes towards high-tech-based manufacturing contribute to catching-up process, one could find that Latvia and Latvian regions actively participate. This is the strategic aim for future economic growth also (Ekonomikas Ministrija 2013). Several reasons for being involved in diversification of manufacturing became especially topical after severe GDP decline in Latvia. This due to wrong expectations that labour-intensive service sectors could provide long-term sustainable economic growth and due to position of low-tech manufacturing sector also, which is brightly ahead of high-tech sector by employees involved and value added produced.

The data on structural change indices indicate on relatively high activity of manufacturing restructuring, but the issue on relative persistence of technological structure of manufacturing in Latvia is topical. Arguments, which hold this statement, find confirmation in values, dynamic and nature of structural changes (Table 1).

Table 1. Characteristics of structural changes in manufacturing in Latvia, 2000-2011[1].

Nature of structural changes	Structural change indices (SCI (speed), MLI (intensity))	Correlation coefficients (for structural changes and real GDP growth)
SCI, *between* "High-, me-high-tech" and "Low-, me-low-tech" sectors	2.27	0.363
SCI, *within* "High-, me-high-tech" sector	13.11	-0.603*
SCI, *within* "Low-, me-low-tech" sector	10.8	-0.818**
MLI, *between* "High-, med-high-tech" and "Low-, me-low-tech" sectors	3.21	0.355
MLI, *within* "High-, me-high-tech" sector	13.10	-0.618*
MLI, *within* "Low-, me-low-tech" sector	9.95	-0.821**

Data on Table 1 demonstrate nature of structural changes occurred in manufacturing in Latvia from 2000 to 2011. In accordance with author's calculations, preservation of the existing technological structure took a place in Latvia. Predominance of structural changes within "High-, me-high-tech" and within "Low-, me-low-tech" sectors rather than between these sectors indicates on this. Calculations made by the author present that $SCI_{\text{within "High-, me-high-tech"}} = 13.11$, $MLI_{\text{within "High-, me-high-tech"}} = 13.10$ and $SCI_{\text{within "Low-, me-low-tech"}} = 10.80$, $MLI_{\text{within "Low-, me-low-tech"}} = 10.95$. In turn, structural changes, which can contribute to changes of overall technological structure of manufacturing – between "High-, me-high-tech" and "Low, me-low-tech" sectors – demonstrate in times lower values, respectively 2.27 points for speed of structural changes (SCI) and 3.21 points for intensity of structural changes (MLI). Data on dynamic analysis (Appendix A, Fig. A1, a) indicate that structural changes in manufacturing mostly occurred due to high activity of me-high-tech and me-low-tech sectors.

Table 1 presents also a meaning of different kinds of structural changes for GDP growth. Correlation coefficients of relationship between change and growth confirm that structural changes, which keep Latvia in frames of the existing technological structure of manufacturing, closely relate to GDP growth. Although, coefficients express negative values (correlation coefficients' values for structural change "within" vary from -0.603* to -0.821**) and brighter are those for "Low-, me-low-tech" sector (Table 1). The data calculated indicate that further analysis of structural changes in manufacturing is necessary due to the following reasons. First, a knowledge about nature of dominating structural changes (Table 1) stimulates interest to understand consequences of opposite (high- and low-tech activities) developments on performance of economic agents involved (regions). Second, regional differentiation, similarity by average growth rates (Table 2) and regional specialization (Fig. 1.) provides thankful base for testing effects of structural changes on regional economic growth.

[1] Note: Pearson correlation, N=12. **. Correlation is significant at the 0.01 level and *. Correlation is significant at the 0.05 level. High-tech – high technology; me-high-tech – medium high technology; me-low-tech – medium low technology; low-tech – low technology. Source: author's calculations based on European Commission – Eurostat.

Table 2. Dispersion of Latvian regions by average values of GDP[2].

Region	Region's GDP share in country's GDP, % (average for 2005-2012)	GDP per capita, euro (average for 2005-2012)	GDP per capita (average growth)
Riga region	66.7	22500.4	110.1
Kurzeme region	10.7	7415.6	108.1
Zemgale region	8.0	5916.4	111.7
Vidzeme region	6.5	5777.3	109.8
Latgale region	7.9	4905.3	112.7

Economic performance of Latvian regions represents approximately gap in 6 times between Riga region and other regions by regional share in Latvia's GDP, about 5 times gap by GDP per capita, but very similar average growth rates of GDP per capita, which vary from 108.1 to 112.7 (Table 2). The characteristics indicated allow author to suppose that differentiated results and similar process can find its roots in regional specialization. Previous research (Šipilova 2013a; Šipilova, Baldi 2013) indicated that specialization is an important factor, which affects formation of high regional differentiation (basically, between Riga region and other regions).

Scientific literature explores that specialization upgrades GDP per capita (Amiti 1999; Welfens, Perret 2010), but mostly in case of high-tech specialization (Welfens, Perret 2010). Data about Latvian regions (Fig. 1.) present some contradictions. Author found out that regions have tendency to change their specialization and that this process by its sense discovers the aim to reallocate resources towards technology-intensive sectors of manufacturing. Calculations made for Latvian regions allow to highlight that regions, which specialize in a low- and me-low-tech sectors (Vidzeme, Kurzeme and Zemgale regions) strengthen their presence in me-high-tech sector and significantly increase LQ values (respectively $\Delta LQ = +0.32$ for Vidzeme, +0.19 for Kurzeme and +0.33 for Zemgale). In turn the region, which specialized in me-high-tech sector during long period, go on and develop specialization in high-tech sector ($\Delta LQ = +0.13$ for Latgale region). Regions with brightly expressed regional specialization are the leaders of changes (by highest positive values of ΔLQ). These are Vidzeme (specializes in dominant sector of Latvian manufacturing, $LQ_{low\text{-}tech} = 1.19$) and Kurzeme ($LQ_{me\text{-}low\text{-}tech} = 1.65$) regions. These regions demonstrate increase by more than 0.30 points towards increasing regional specialization in technologically more intensive sectors of manufacturing (Fig. 1.)

Measurement of trajectories of structural changes indicates on obviously increasing specialization in me-high-tech sector (Fig. 1.). Although, the existing regional spread of specialization questions the quality of this process, because the impact of increasing specialization in "High-, me-high-tech" sector on regional GDP growth and regional convergence in Latvia is relatively weak (Table 2, Table 3).

[2] Note: Source: author's calculations by Central Statistical Bureau of Latvia

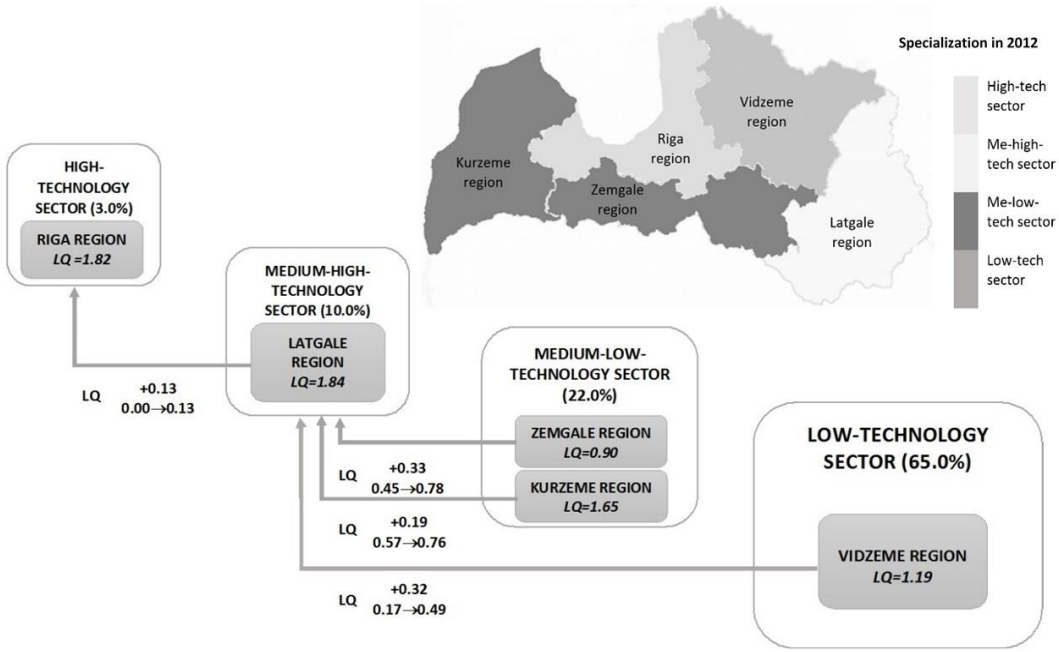

Fig. 1. Trajectories of increasing of specialization in Latvian regions, 2005-2012, displayed max ΔLQ values[3]

In terms of explaining the effect of structural changes on economic growth in Latvian regions, it would be worth to highlight that specialization in high-tech and me-high-tech manufacturing characterizes the region leader (Riga region) and the region follower with the lowest GDP per capita (Latgale region) (Table 2). Moreover, regional GDP dispersion indicates on necessity to examine why regions (except Riga), which specialize in me-low-tech sector are ahead of region, which previously proved its presence in me-high-tech sector. One could argue that the process of increasing of specialization matters (Fig. 1.). Partly, author could agree with this, but the region follower (Latgale region) has more than twice higher LQ value (LQ = 1.84) for me-high-tech sector than Kurzeme (LQ = 0.76), Zemgale (LQ = 0.78) and Vidzeme (LQ = 0.49) regions after structural changes (Fig. 1.). Additionally, the linkage between changes in specialization and changes in regions' share in Latvia's GDP discovers relatively weak reflection of change of specialization in regional growth (Table 3).

[3] Note: Size of the squares schematically demonstrates shares of each manufacturing sector. Data in percentage placed near sectors' title indicate each sector's share in manufacturing in Latvia in 2012; LQ values placed near regions' titles demonstrate regional specialization in 2012. Regions are placed in the squares in conformity with data on regional specialization. Arrows indicate direction of increasing of specialization (max positive ΔLQ values). Data on LQ values indicates on specialization value in 2005 and in 2012 and ΔLQ (for detailed ΔLQ see Appendix A, Fig. A1, b). The map of Latvia schematically illustrates geographical spread of specialization across Latvian regions in 2012 in accordance with max LQ values. Source: author's calculations by Central Statistical Bureau of Latvia.

Table 3. Correlation between changes in specialization and changes in regions' share in Latvia's GDP, 2005-2012[4].

Manufacturing sector	NACE Rev. 2, 2-digit level	Riga region	Kurzeme region	Zemgale region	Vidzeme region	Latgale region
High-tech sector	C21	-.266	-	-.969**	-	.338
	C26	-.544	.194	-.890**	-.821*	.252
Me-high-tech sector	C20	.592	-.228	-.122	-.550	.271
	C27	.499	-.304	.873**	.808*	.257
	C28	.477	-.268	.949**	.702	-.044
	C29-30	.465	.293	.965**	.494	-.264
Me-low-tech sector	C22-23	.544	-.260	-.502	-.773*	-.195
	C24-25	.462	.605	.875**	.595	-.050
Low-tech sector	C10-12	-.612	.244	-.806*	.749*	.176
	C13-15	.477	-.495	.838**	.668	.000
	C16-18	.531	-.222	.979**	.766*	-.461
	C31-33	-.551	-.436	-.834**	-.818*	.058

Data on Table 3 discover that regardless of specialization, direction of its increasing and regional economic performance, the linkage between indicators of change and growth dynamic mostly is weak (Table 3). Additionally, the case of Zemgale region demonstrates close relationship between all kinds of specialization (in accordance with manufacturing technological aggregation) and region's growth, what one more time highlights necessity to search reasons beyond frames of technological intensity also. Unique regional experience, but similar tendencies presented by data on correlation (Table 3) welcomes to turn further discussion to the searching for reason, which hinders ability of regions to increase prosperity by putting high-tech sector in a fore of regional specialization. Taking into account theoretical arguments about high significance of labour productivity for growth (Baumol 1967; Hartwig 2010), author searches explanation in labour productivity at sectoral level.

Results of the previous calculations (Table 1, Fig. 1.) indicate on positive tendency to reallocate resources to technologically more intensive sectors. The reasons for absence of desirable effect on regional growth lie in the labour productivity growth in accordance with calculations made in the framework of shift-share analysis technique. The data presented (Fig. 3.) provide detailed account on effectiveness of production process in manufacturing at sectoral level.

[4] Note: Pearson correlation, N=8. **. Correlation is significant at the 0.01 level and *. Correlation is significant at the 0.05 level.

Table 3 presents data about the following industries: Manufacture of – food products; beverages and tobacco products (C10-12); textiles, wearing apparel, leather and related products (C13-15); wood, paper, printing and reproduction (C16-C18); chemicals and chemical products (C20); basic pharmaceutical products and pharmaceutical preparations (C21); rubber and plastic products and other non-metallic mineral products (C22-23); basic metals and fabricated metal products, except machinery and equipment (C24-25); computer, electronic and optical products (C26); electrical equipment (C27); machinery and equipment n.e.c. (C28); motor vehicles, trailers, semi-trailers and of other transport equipment (C29-30); furniture; jewellery, musical instruments, toys; repair and installation of machinery and equipment (C31-33).

Industry "Repair and installation of machinery and equipment" (33) belongs to the me-low-tech sector in conformity with basics of manufacturing high-tech aggregation by Eurostat based on NACE rev. 2. Although, the NACE rev. 2 classification of economic activities includes the industry (33) in the group "Manufacture of furniture; jewellery, musical instruments, toys; repair and installation of machinery and equipment" (31-33), where industries "Manufacture of furniture" (31) and "Other manufacturing" (32) relate to the low-tech sector. Taking into account limitations of statistical data and peculiarities of statistical classification of NACE rev. 2 author provides calculations for industry (31-33) and places it to the low-tech sector. Source: author's calculations by Central Statistical Bureau of Latvia.

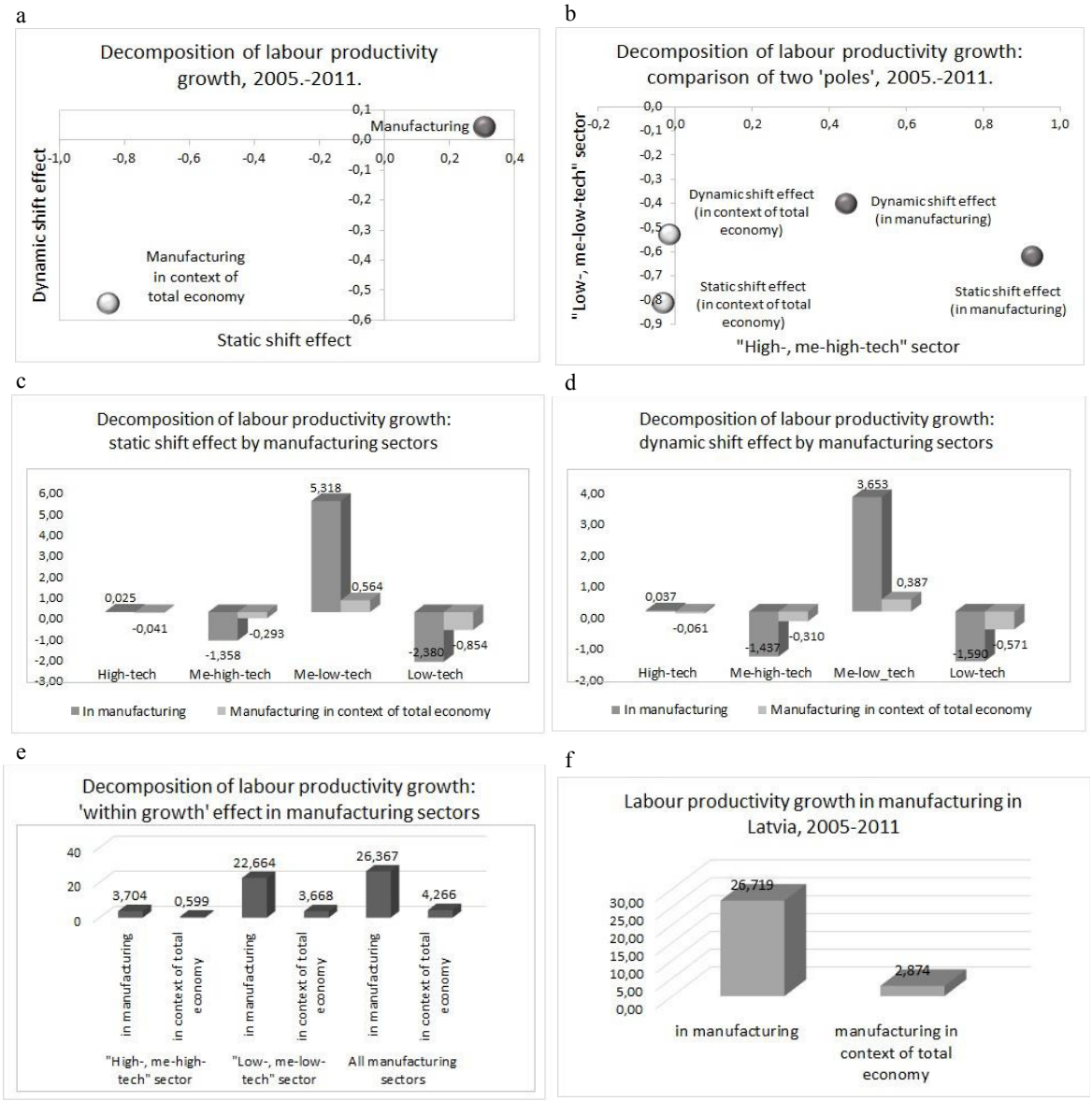

Fig. 2. Labour productivity growth in manufacturing in Latvia, 2005-2012[5]

Manufacturing fulfils conditions of "structural bonus" hypothesis, because the value of static shift effect is positive (0.309), although relatively low. This means, that manufacturing demonstrates positive relationship with economic

[5] Note: Calculations made using shift-share analysis technique (Peneder 2002, Havlik 2005). Number of items during calculations vary: n=4 (Fig. 3 a, f); n=2 (Fig. 3 b, e) and n=1 (Fig. 3 c, d). This due to limitations of statistics on Latvian manufacturing at NACE 2 rev. 2-digit level, moreover this contributes to the precise presenting of sectors' contribution in the labour productivity growth based on high-tech aggregation. Source: author's calculations based on European Commission – Eurostat (for Fig. 3 a, b, e, f), Central Statistical Bureau of Latvia (for Fig. 3 c, d).

growth. Moreover, manufacturing reaches positive value of dynamic shift effect (0.043), which indicates on non-fulfilment of "structural burden" hypothesis and makes stronger a positive relationship between manufacturing and economic growth (Fig. 3. a). The situation changes, when author makes calculations for manufacturing in context of total economy. In this case, manufacturing fulfils conditions of "structural burden" hypothesis, because value of dynamic shift effect is negative (-0.545). This demonstrates that low-productive sectors have enriched by labour force reallocation. In addition, static shift effect is negative value (-0.847) also and thus, "structural bonus" hypothesis does not hold (see Fig. 3. a). Static and dynamic shift effects have higher values in case of calculations for manufacturing only, what indicates on weakening of manufacturing's position in context of total economy. Taking into account that share of manufacturing sectors vary significantly and specialization in technologically more intensive sectors does not improve positions of economically less developed region, author tests relatively more positive contribution of "High, me-high-tech" sector in labour productivity growth (Fig. 3., b) at more detailed sectoral level (Fig. 3. c, d).

These calculations highlight that only me-low-tech sector demonstrates brightly expressed positive values of static shift effect and thus fulfils conditions of "structural bonus" hypothesis both, for manufacturing (5.318) and for manufacturing in context of total economy (0.564). Taking into account that share of me-low-tech sector is 3 times lower than share of low-tech sector, positive effect provided by me-low-tech sector does not reflect in overall effect of "Low-, me-low-tech" sector (Fig. 3. b). Other sectors, except high-tech sector, non-fulfils conditions of "structural bonus" hypothesis. In turn, high-tech sector holds "structural bonus" hypothesis only in manufacturing and is low-productive sector in context of total economy (see Fig. 3. c, d).

Me-high-tech sector, which more often is destination for resource reallocation at regional level, does not fulfil conditions for "structural bonus" hypothesis; in turn, "structural burden" hypothesis fulfilled for this sector both, in manufacturing and in context of total economy (see Fig. 3. c, d). In case of assumption structural change did not take a place, manufacturing in bigger extent could enrich from labour productivity growth in "Low-, me-low-tech sector" (Fig. 3. e).

Table 4. Relationship between GDP per capita and labour productivity at sectoral level[6].

Labour productivity at sectoral level *(independent variable)*	Regression (LOG-LOG model) GDP per capita *(dependent variable)*					
	Latgale region			Kurzeme region		
	Coefficient	p-value (Sig.)	R^2	Coefficient	p-value (Sig.)	R^2
Me-high-tech labour productivity	.858	.006	0.7369	.795	.018	0.6319
Me-low-tech labour productivity	.708	.049	0.5016	.760	.029	0.5781
Number of observations	16					
Labour productivity at sectoral level	Correlation (Pearson, N=8) GDP per capita					
	Latgale region			Kurzeme region		
Me-high-tech labour productivity	.796*			.731*		
Me-low-tech labour productivity	.714*			.756*		

[6] Note: Number of observations = 2 (regions)*8 (years). *. Correlation is significant at the 0.05 level. Latgale and Kurzeme are case studies because of peculiarities of regional specialization (Fig. 1; Appendix A, Fig. A1, b). Data on opposite tendencies in labour productivity growth, values of specialization and level of technological intensity are reasons for choosing me-high- and me-low-tech sectors. Source: author's calculations based on Central Statistical Bureau of Latvia.

As far as labour productivity is important factor, this is valuable knowledge for future structural changes that manufacturing experiences labour productivity growth, but this growth declines significantly in case of calculations in context of total economy (Fig. 3. f). Further analysis (Table 4) explores relationship between GDP per capita and labour productivity at sectoral level using the case studies. Regional growth (GDP per capita) in bigger extent depends on technologically less intensive but higher-productive me-low-tech sector. This holds for both, Latgale region with brightly expressed specialization in me-high-tech sector and for Kurzeme region with dominant specialization in me-low-tech sector, but strong increasing of specialization in me-high-tech sector. Results of regression and correlation analysis provide evidence that at stage, when technologically intensive sector (me-high-tech) are low productive within manufacturing and in context of total economy, technologically less intensive, but high-productive sector (me-low-tech) can contribute in regional growth in bigger extent. Calculations made by author indicate that labour productivity growth by 1% in me-low-tech sector provides higher growth of GDP per capita, regardless of specialization (see Table 4, Appendix B, Fig. B1, a, b, c, d). For example, regression analysis results allow supposing that labour productivity growth in me-high-tech sector by 1% will increase GDP per capita by about 0.82%, but this in me-low-tech sector will upgrade GDP per capita by 0.98%. This for region, which specializes in me-high-tech sector (Latgale region). In turn, Kurzeme region after brightly expressed reallocation of labour resources towards me-high-tech sector, reaches higher GDP increase (0.74%) after me-low-tech productivity growth by 1%. Improvements in labour productivity in me-high-tech sector will stimulate GDP per capita growth by about 0.53% in Kurzeme region.

5. Conclusion

The article questions, when regional growth does not benefit from high-tech specialization and could technologically less intensive sectors contribute to the growth in bigger extent in this case, using the experience of Latvian regions. Author finds out that this takes a place, when technologically higher intensive sectors are less productive (comparing them with other sectors). Moreover, regional growth can benefit from technologically less intensive sectors with higher labour productivity level at this stage. The case of me-high-tech and me-low-tech sectors holds this for the case of the Latvian regions. Therefore, regions should pay attention for both, improvements in technological structure of manufacturing and labour productivity growth taking into account regional potential, regional sectoral structures and its technological intensity. Moreover, regional ability to close technological gap and to avoid imitating of other, usually, economically higher developed regions makes the process effective.

Appendix A. Dynamic of technological structure of manufacturing in Latvia and regions

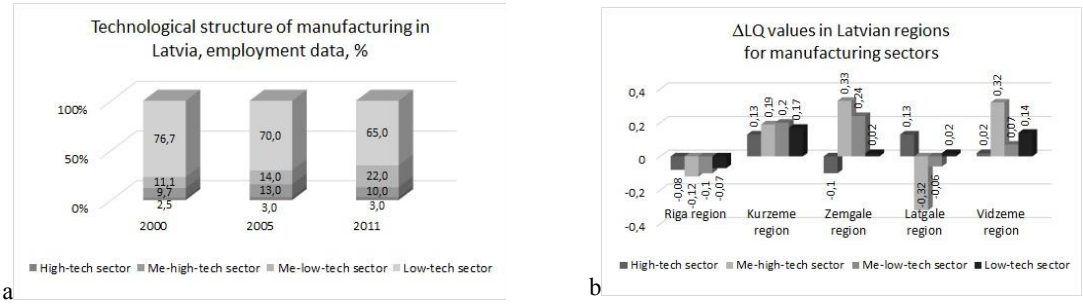

Fig. A1. Technological structure of manufacturing in Latvia (2000-2011) and its changes at regional level (2005-2012)[7]

[7] Note: Source: author's calculations based on Central Statistical Bureau of Latvia

Appendix B. Visualization of regression (LOG-LOG model) for case studies of Latgale and Kurzeme regions

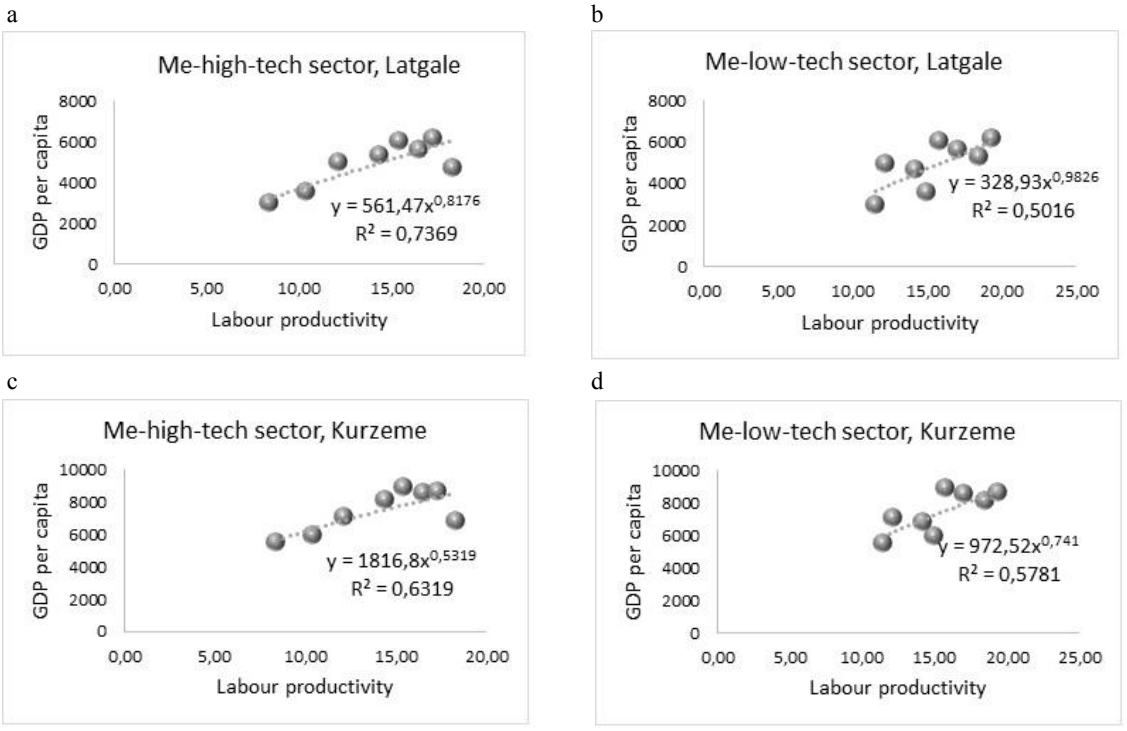

Fig. B1. Relationship between GDP per capita and labour productivity at sectoral level (2005-2012)[8]

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[8] Note: Source: author's calculations based on Central Statistical Bureau of Latvia

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